# Carbon Footprint Report
# Christchurch International Airport Limited

FY19

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# Executive Summary

This greenhouse gas inventory report for the reporting year 2018-19 to support CIAL in to assist in advancing their current Airport Carbon Accreditation to Level 4 – Transformation. As a requirement for an upgrade to Level 4, Christchurch International Airport Limited needs to submit a carbon footprint of the airport's scope 1, 2 and 3 emissions. The Airport Carbon Accreditation program recommends that all relevant data and information for establishing the carbon footprint be consolidated into a carbon footprint report. This document serves as that carbon footprint report. Emission sources included in the carbon footprint, corresponding activity data, methodologies, assumptions, limitations and emission estimates, as well as organisational and operational boundaries are detailed in this report.

Table 1 summarises the GHG inventory for FY19.

**Table 1: FY19 GHG emissions**

| | Scope 1 | Scope 2 | Scope 1 + 2 | Scope 3 | Scope 1 + 2 + 3 |
|---|---|---|---|---|---|
| **FY19** | 1,242 | 1,262 | 2,504 | 511,308 | 513,812 |

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# 1. Introduction

Conversio has been engaged by Christchurch International Airport Limited ('CIAL') to prepare this greenhouse gas ('GHG') inventory report ('carbon footprint') for the reporting year 2018-19 to support CIAL in to assist in advancing their current Airport Carbon Accreditation to Level 4 – Transformation.

The ACA program is a global carbon management certification program for airports. It independently assesses and recognises the efforts of airports to measure, manage and reduce their GHG emissions through 4 levels of certification: 'Mapping' (Level 1), 'Reduction' (Level 2), 'Optimisation' (Level 3), 'Neutrality' (Level 3), and 'Transformation' (Level 4). CIAL is required to submit a carbon footprint annually of the airport's scope 1, 2 and 3 GHG emissions.

Additional requirements at Level 4 include the formulation of a long-term absolute reduction target for scope 1 and 2, or scope 1, 2 and selected scope 3 GHG emissions which is in line with the IPCC 1.5°C or 2°C pathways, development of a carbon management plan which sets out the reduction trajectory and the measures required to achieve the target, as well as the development of a stakeholder partnership plan which details GHG emissions reduction targets and measures leading to effective reductions of Christchurch International Airport's scope 3 GHG emissions.

This carbon footprint has been prepared in accordance with the requirements set out under ISO 14064-1:2018 (Part 1: Specification with guidance at the organization level for quantification and reporting of greenhouse gas emissions and removals), the GHG Protocol's Corporate Standard and Corporate Value Chain (Scope 3) Standard, as well as the requirements set out under the ACA for Level 4 accreditation. Organisational and operational boundaries are set according to the GHG Protocol.

Table 2 summarises the total scope 1 and 2 emissions, scope 3 emissions for FY2018-2019.

**Table 2: Total scope 1, 2 and 3 emissions in tonnes $CO_2$-e in FY2018-19**

| | Scope 1 | Scope 2 | Scope 1 + 2 | Scope 3 | Scope 1 + 2 + 3 |
|---|---|---|---|---|---|
| **FY19** | 1,242 | 1,262 | 2,504 | 511,308 | 513,812 |

# 2. Description of Christchurch International Airport

Christchurch Airport is located 10 kilometres northwest of Christchurch city centre, on the western city development edge and is a critical piece of significant national and regional infrastructure. CIAL is responsible for the efficient and safe operation of Christchurch Airport and aims to provide the airport's diversity of users with modern, appropriate and competitive facilities and services. Ownership of CIAL is shared 75% by Christchurch City Holdings Limited and 25% by the New Zealand Government.

As the international gateway for Christchurch and the South Island, Christchurch Airport is a major hub and the busiest and most strategic air connection to the world's trade and tourism markets. The airport is New Zealand's second largest airport with 10 partner airlines coming from 22 destinations. It provides a significant contribution to both the Canterbury region and the South Island as a whole, with the total airport operation employing more than 6,500 employees across a diverse range of companies.

A record 6.9 million passengers travelled in and out of Christchurch Airport in the 2018 financial year (FY18) - that's more than 6 times the population of the South Island. International passenger arrivals grew by 8.5% while overall arrivals for New Zealand grew by 3.9%. Key international markets where Christchurch grew faster than the rest of New Zealand were Australia (+7.8%), China (+26.6%), Europe (+7.7%) and the United States (+11.8%).

# 3. Reporting requirements

CIAL has been participating in the ACA program at Level 2 since 2018 and is intending to upgrade to Level 4. The ACA requires that emissions are reported in line with the GHG Protocol and that airports also identify where they have direct control over emissions (generally scope 1 and 2 emissions) and where they can guide or influence emissions from other organisations' activities and facilities (mainly scope 3).

As a requirement for accreditation at Level 4, CIAL needs to submit an annual carbon footprint of the airport's scope 1 and 2 emissions, as well as relevant scope 3 emissions. The ACA program recommends that all relevant data and information for establishing the carbon footprint be consolidated into a carbon footprint report. This document serves as that carbon footprint report.

A requirement of Level 4 accreditation is that the airport aligns its absolute long-term target with the IPCC's 1.5°C or 2°C pathways and demonstrates progress against this trajectory. This carbon footprint report should be updated annually to allow comparison of annual GHG emissions, ensure the airport stays within 15% of that trajectory, and meet the long-term targets and interim milestones.

The list of scope 3 emission sources included in this report can be found in section 6.4 of this report.

# 4. Methodology

## 4.1 Methodologies

The following standards and guidelines provide the basis for this GHG inventory:

- The requirements set out in the ACA Application Manual, Issue 12, October 2020,
- The New Zealand Ministry for the Environment's Measuring Emissions: A Guide for Organisations, MfE Guide 2019 ('MfE Guide 2019'),
- ISO 14064 Greenhouse gases Part 1: Specification with guidance at the organization level for the quantification and reporting of greenhouse gas emissions and removals,
- The relevant GHG Protocol standards and guidance, specifically the
  - Corporate Accounting and Reporting Standard (revised edition),
  - Corporate Value Chain (Scope 3) Accounting and Reporting Standard,
  - Technical Guidance for Calculating Scope 3 Emissions (version 1.0), and
  - Scope 2 Guidance.
- The guidance and recommendations set out under the
  - Airports International Council's Guidance Manual: Airport Greenhouse Gas Emissions Management, and
  - Airport Cooperative Research Program's Guidebook on Preparing Airport Greenhouse Gas Emissions Inventories.

## 4.2 Emission factors

In establishing the GHG inventory, Conversio used emission factors and calculation methodologies available in:

- The MfE Guide 2019[1],
- The Airport Council International's Airport Carbon and Emissions Reporting Tool ('ACERT'), and
- The ICAO CORSIA $CO_2$ Estimation and Reporting Tool.

[1] Please note that for staff business air travel, the 2018 UK Department for Business, Energy & Industrial Strategy's conversion factors are referenced in the MfE Guide 2019.

## 4.3 Location-based and market-based emission factors for scope 2 emissions

The ACA program requires airports that operate in markets with access to contractual agreements to report scope GHG emissions using both the location-based and market-based approach (s5.4.2 ACA Application Manual). The location-based approach uses the average emission factor specific to the grid on which the energy consumption occurs. In the case of CIAL, this is the New Zealand grid. As such, the scope 2 emission factor for purchased electricity is the same as the one in section 5.2 of the MfE Guide 2019.

The market-based method reflects emissions from electricity purchases that companies have purposefully chosen in form of contractual instruments, such as green power options, renewable energy certificates ('REC's), carbon neutral electricity options, direct energy supply contracts, supplier-specific emission factors, or other emission factors representing the untracked or unclaimed energy and emissions (residual mix).

New Zealand does not publish a residual mix and CIAL does not make use of contractual agreements available in the New Zealand energy market. As such, the location-based and market-based emission factors for scope 2 emissions are deemed to be identical (see Table 3 for the emission factors associated with electricity purchased from the grid).

**Table 3: Electricity purchased from grid**

| Emission source | Scope | Unit | kg CO2-e/unit |
|---|---|---|---|
| Purchased electricity | 2 | kWh | 0.0977 |
| Transmission and distribution losses for electricity | 3 | kWh | 0.0074 |

## 4.4 Method for calculating emissions

Unless otherwise stated, the method for calculating GHG emissions associated with fuel and electricity consumption is as follows:

- Petrol consumption: Amount of the liquid fuel delivered for the facility during the year as evidenced by invoices issued by the vendor of the fuel;
- Diesel oil consumption: Amount of the liquid fuel delivered for the facility during the year as evidenced by invoices issued by the vendor of the fuel;
- Liquefied petroleum gas consumption: Amount of the liquid fuel delivered for the facility during the year as evidenced by invoices issued by the vendor of the fuel;
- Electricity consumption: Based on supplier invoices; and
- Refrigerant use: Based on amount topped up during reporting year as reported by supplier.

## 4.5 Rounding of amounts

If the amount for tonnes $CO_2$-e worked out under a carbon footprint is not a whole number, the number is rounded up to the next whole number if the number at the first decimal place equals or exceeds 5 and rounded down to the next whole number if the number at the first decimal place is less than 5.

## 4.6 Parameter uncertainty

Parameter uncertainty relates to the uncertainty associated with the accuracy of emission factors. In the context of emission factors, systematic uncertainty (data that is systematically biased because of incorrect or incomplete estimation methods) and/or statistical uncertainty (errors in measurement process and fluctuations in measurement equipment) can occur. The following are the uncertainties associated with the emission factors for fuels used for stationary and transport purposes as published in the MfE Guide 2019.

Stationary:

- Diesel = ±0.5%
- Liquefied petroleum gas = ±0.5%

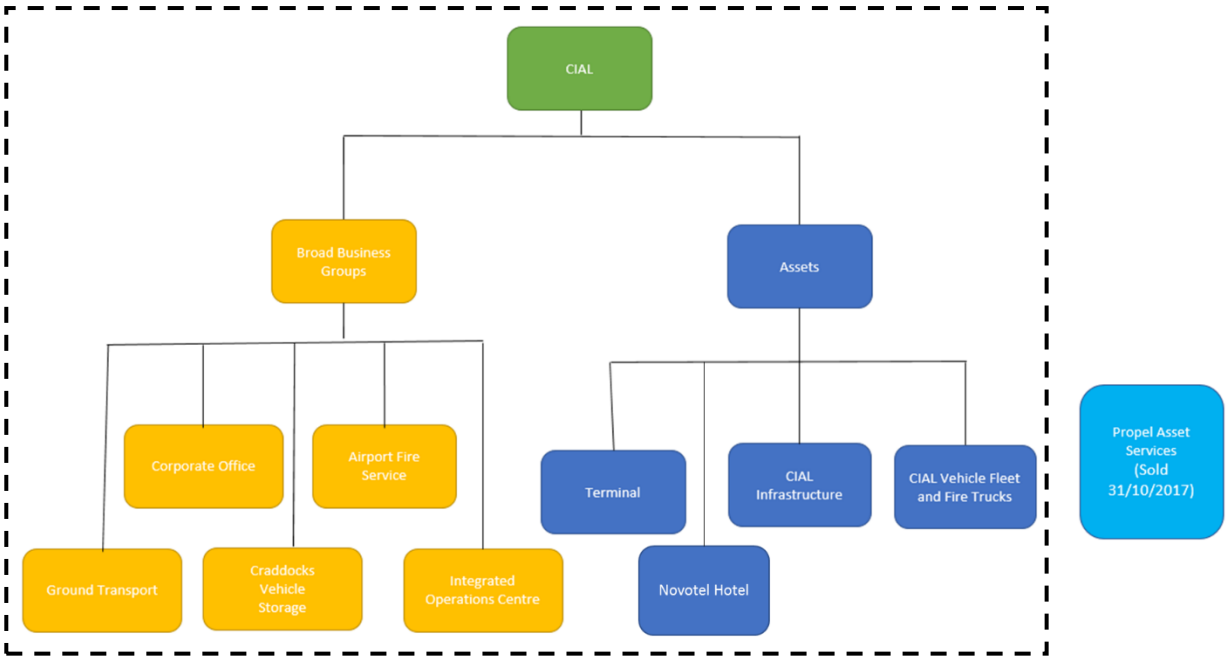
Transport:

- Petrol = ±1.8%
- Diesel = ±0.9%
- Liquefied petroleum gas = ±1.3%

# 5. Organisational Boundary and operational control approach

The organisational boundary determines which parts of CIAL are included in the GHG inventory. In the context of airport operations, determining greatest authority to introduce operating, health and safety, and environmental policies can be complex and may be dependent on the contractual relationship between various parties. In some circumstances, the greatest authority will rest with CIAL as the corporation with day-to-day on-site managerial responsibility. This, however, must be balanced against the ability to introduce operating and environmental policies, which can sometimes rest with the tenant.

**Figure 1: Organisational boundary**




CIAL has adopted the following position:

- Where tenants are separately metered and billed by the electricity or gas provider or sub-metered within the airport and have the ability to control their own energy use, these are treated as facilities outside CIAL's operational control;
- Where CIAL purchases electricity or gas from a provider and on-sells it to sub-metered tenants who have the ability to control their own energy use, the associated emissions are treated as being outside CIAL's operational control;
- Where sub-metered leased space is/becomes vacant, CIAL's assumes operational control until such time that space is leased by a tenant; and
- Where CIAL on-sell electricity, but do not sub-meter electricity or gas, the associated emissions are treated as being within CIAL's operational control.

CIAL has also completed construction of a hotel on its property. In determining operational control, CIAL has adopted the following position: CIAL owns the hotel, which is branded as Novotel. Hind Management operates the hotel on CIAL's behalf, invoices will be paid from CIAL accounts. This approach aligns with the above position of assuming operational control when CIAL is the entity paying for energy invoices.

# 6. Operational Boundary

The operational boundary determines which emission sources will be quantified. Participation in the ACA program at Level 3 requires that all scope 1 (direct), scope 2 (indirect), and all relevant scope 3 (other indirect) emissions be reported.

## 6.1 Greenhouse gases

Emissions from carbon dioxide ($CO_2$), methane ($CH_4$), nitrous oxide ($N_2O$), specified kinds of hydrofluorocarbons and (HFCs) are included in this GHG inventory. Emissions are measured in tonnes of carbon dioxide equivalent (t $CO_2$-e). The carbon dioxide equivalent ($CO_2$-e) allows the different greenhouse gases to be compared on a like-for-like basis relative to one unit of $CO_2$. $CO_2$-e is calculated by multiplying the emissions of each of the four GHGs covered in this report by its 100-year global warming potential (GWP) specified in the IPCC's Fourth Assessment Report[2].

## 6.2 Definition of scopes

The ACA program uses the GHG Protocol's operational boundary definitions for describing direct and indirect emissions. As such, scope 1, scope 2 and scope 3 are defined as per the GHG Protocol and the ACA Guidance Document, Issue 11, page 13 (see also Figure 2 for an overview for emission sources as per ACA program):

Scope 1: Direct GHG emissions that occur from sources that are owned and/or controlled by the airport, such as emissions from the combustion of fuels in owned/controlled generators and vehicles.

Scope 2: Indirect emissions from the generation of purchased electricity consumed by the airport.

Scope 3: All other indirect emissions, which are the consequence of the activities of the airport, but occur from sources not owned and/or controlled by the airport, such as aircraft movements, GSE, transmission and distribution losses, APU usage, etc.

[2] The MfE Guide 2019 erroneously refers to the IPCC's "Annual Report". The correct name is "Assessment Report".

Figure 2: Emission sources at an airport


## 6.3 Data used for calculating GHG emissions and energy consumption

This GHG inventory is based on the best data available at time of compilation. The discussion of the individual emission sources includes references to the source documents, as well as an outline of methodology and assumptions used in estimating emissions.

Data is aggregated by CIAL's accounting/finance and asset/environment teams.

Based on the data provided and methodologies applied, it is expected that the reported quantity of scope 1 and scope 2 GHG emissions is not significantly different to the true value.

CIAL respects the legal rights of tenants to quiet enjoyment of tenancy and/or the need for information to remain commercial-in-confidence, and therefore, cannot demand data. Instead, CIAL invites tenant and contractor participation in a voluntary data sharing arrangement to estimate scope 3 GHG emissions where this information cannot be estimated using on-sold energy information.

This GHG inventory will be updated should more up-to-date or accurate methodologies and/or emission factors become available or if any significant errors (i.e. resulting in a difference in the reported GHG inventory of more than 5%) are identified.

## 6.4 GHG emissions sources included in carbon footprint

**Error! Not a valid bookmark self-reference.** summarises the GHG emission sources included in this GHG inventory.

**Table 4: GHG emission sources**

| Scope | Emission source | Activity data | Unit | Emission factor | Tonnes $CO_2$-e | Methodology | Activity data source |
|---|---|---|---|---|---|---|---|
| 3 | Aircraft – full flight emissions, half-way method | 115,261 | # annual movements | | 477,874 | CORSIA CERT, custom methodology | Data provided by Financial Analyst |
| 3 | Ground access, including staff commute | 3,583,379 | # annual movements | | 26,777 | ACERT | GT ACERT Data (002).xlsx |
| 3 | Aircraft – APU | 30 | minutes | | 3,201 | ACERT | APU vs FEGP.pdf |
| 3 | Engine testing/ run-ups | 2,727 | # | | 1,486 | ACERT | 20190709 ETMS test report 01 July 2017 to 30 June 2019.xlsx |
| 2 | Purchased electricity | 12,918,973 | kWh | 0.0977 kg $CO_2$-e/kWh | 1,268 | MfE Guide 2019 | 7777 & 9999 HH Data.xlsx, Carbon Source Data 24 july 2019.xlsx (Enercon), CIAL non TOU FY18-19.csv, CIAL TOU FY18-19.csv, ELec Data.msg, Elec data april may 2019.msg, Elec gap between Contact and Meridian.msg, Energy Management - June - 2019.xlsx, Monthly Energy Management v1.xlsm, CIAL - May 19 Energy Management Report.pdf, Campus Electricity.xlsx |
| 1 | B10 biodiesel – stationary | 422,978 | litre | 2.39kg $CO_2$-e/l | 1,011 | MfE Guide 2019 | Monthly Energy Management v1.xlsm (Diesel-Raw), RE Calculating Biodiesel Blends.msg |
| 3 | Purchased electricity, tenants – on-sold and direct from off-site (including GPU) | 3,788,550 | kWh | 0.0977 kg $CO_2$-e/kWh | 407 | MfE Guide 2019 | Carbon Source Data 24 july 2019.xlsx (Enercon) |
| 3 | Staff business travel - air (international, long haul), business | 634,798 | pkm | 0.472kg $CO_2$-e/pkm | 317 | MfE Guide 2019 | ORBIT data Export.xlsx, Travel Summary.docx, Corporate Travel.xlsx |

| Scope | Emission source | Activity data | Unit | Emission factor | Tonnes $CO_2$-e | Methodology | Activity data source |
|---|---|---|---|---|---|---|---|
| 3 | Diesel – transport, tenant (GSE) | 105,085 | litre | 2.69kg $CO_2$-e/l | 283 | MfE Guide 2019 | Air NZ Ramp.msg |
| 3 | LPG – stationary, tenant | 44,801 | kg | 3.03kg $CO_2$-e/kg | 136 | MfE Guide 2019 | Monthly Energy Management v1.xlsm (LPG-Raw) |
| 3 | Electricity transmission & distribution losses | 17,080,721 | kWh | 0.0074 kg $CO_2$-e/kWh | 126 | MfE Guide 2019 | Sum of all purchased grid electricity. |
| 3 | Trade wastewater | 276,944 | m3 | 0.447kg $CO_2$-e/m3 | 124 | MfE Guide 2019 | FY19 Waste Water meter.csv |
| 1 | Diesel – transport | 43,923 | litre | 2.69kg $CO_2$-e/l | 118 | MfE Guide 2019 | Summary - Diesel Transport.xlsx, Carbon Source Data 24 july 2019.xlsx (AFS Fuel, BP Fuel, Mobil Fuel) |
| 3 | Waste to landfill with landfill gas recovery | 487,760 | kg | 0.242kg $CO_2$-e/kg | 118 | MfE Guide 2019 | wASTE CHART EXPORT.xlsx |
| 1 | Refrigerant use – top-up | 54 | kg | GWP 1,430/kg | 78 | MfE Guide 2019 | Refrig data.msg, FW  refrigerant gas and CIAL.msg |
| 3 | Staff business travel - air (domestic), jet aircraft, economy | 405,841 | pkm | 0.089kg $CO_2$-e/pkm | 73 | MfE Guide 2019 | ORBIT data Export.xlsx, Travel Summary.docx, Corporate Travel.xlsx |
| 3 | Staff business travel - air (international, short haul), economy | 415,561 | pkm | 0.160kg $CO_2$-e/pkm | 70 | MfE Guide 2019 | ORBIT data Export.xlsx, Travel Summary.docx, Corporate Travel.xlsx |
| 3 | Staff business travel - air (domestic), medium aircraft, economy | 160,544 | pkm | 0.089kg $CO_2$-e/pkm | 46 | MfE Guide 2019 | ORBIT data Export.xlsx, Travel Summary.docx, Corporate Travel.xlsx |
| 3 | Staff business travel - air (international, long haul), economy | 248,931 | pkm | 0.163kg $CO_2$-e/pkm | 43 | MfE Guide 2019 | ORBIT data Export.xlsx, Travel Summary.docx, Corporate Travel.xlsx |
| 3 | Electricity - tenants, purchased from supplier (direct from off-site) | 373,198 | kWh | 0.0977 kg $CO_2$-e/kWh | 36 | MfE Guide 2019 | Campus Electricity.xlsx |

| Scope | Emission source | Activity data | Unit | Emission factor | Tonnes $CO_2$-e | Methodology | Activity data source |
|---|---|---|---|---|---|---|---|
| **3** | De-icing, tenant | 40,275 | litre | | 35 | ACERT | Deicing_Records_AirNZ_Planebiz.xlsx, Deicing_Records_Master_Spreadsheet.xlsx |
| **3** | Staff business travel - air (international, short haul), business | 131,117 | pkm | 0.240kg $CO_2$-e/pkm | 33 | MfE Guide 2019 | ORBIT data Export.xlsx, Travel Summary.docx, Corporate Travel.xlsx |
| **3** | Staff business travel – accommodation | 554 | # hotel nights | kg $CO_2$-e/night, see Table 33 | 20 | MfE Guide 2019 | ORBIT data Export.xlsx |
| **1** | Petrol – transport | 6,835 | litre | 2.45kg $CO_2$-e/l | 17 | MfE Guide 2019 | Carbon Source Data 24 july 2019.xlsx (AFS Fuel, BP Fuel, Mobil Fuel) |
| **1** | LPG – stationary | 5,086 | kg | 3.03kg $CO_2$-e/kg | 15 | MfE Guide 2019 | Monthly Energy Management v1.xlsm (LPG-Raw) |
| **1** | Fire training – LPG | 751 | kg | | 2 | ACERT | 20171009_Elgas invoice.pdf, 20180718_Elgas Invoice.pdf |
| **3** | Staff business travel - air (domestic), small aircraft, economy | 2,796 | pkm | 0.142kg $CO_2$-e/pkm | 2 | MfE Guide 2019 | ORBIT data Export.xlsx, Travel Summary.docx, Corporate Travel.xlsx |
| **1** | Fire training – wood | 8,325 | kg | | 1 | ACERT | 201811_City firewood invoice.pdf, 20190611_City Firewood invoice.pdf, CIty Firewood export.xlsx |
| **1** | Fire training – fire extinguishers | 135 | kg | | 0 | ACERT | RE  CO2 training use.msg |

## 6.5 Assumptions, limitations and justifications

Table 5 below summarises relevant assumptions, limitations and justifications.

**Table 5: Assumptions, limitations and justifications**

| Scope | Emission source | Assumptions, limitations and justifications |
|---|---|---|
| 1, 2, 3 | All - rounding | Minor (i.e. insignificant) differences in GHG estimates are due to rounding of emission factors and an inconsistent use of the number of decimal places in the MfE 2019 Guide and the corresponding flatfile provided by the MfE. Conversio has used the emission factors provided in the flatfile as the basis of the GHG emission calculations except for calculations done using the ACERT and the emission factor for biodiesel provided by the MfE.<br>See also section 4.5 of this report. |
| 1, 2, 3 | Known issue with GHG estimates in ACERT | There is an issue with the calculations/formulas in the ACERT v5.1. For most emission sources in the 'Output' tab the amount for tonnes $CO_2$-e do not equal the corresponding sum of $CO_2$, $CH_4$ and $N_20$. Both the ACI ACERT and ACA administrator were made aware of this issue. The ACI acknowledged the existence of discrepancies in the ACERT which remained in the tool across versions due to resourcing constraints[3]. The ACA administrator advised that until the exact issue has been identified and corrected the $CO_2$-e value should be considered for verification[4].<br>As such, amounts of tonnes $CO_2$-e referred to in this report and the calculation spreadsheet as calculated using the ACERT are those as reported in column J of the 'Output' tab of the ACERT v5.1. |
| 3 | Scope 3 GHG emission estimates | Achieving a complete GHG inventory can require using less accurate or complete scope 3-related data, which can affect accuracy and completeness. It can be difficult to determine or verify the source and quality of scope 3 emissions data supplied by third-parties. Conversio believes this GHG inventory achieves a sufficiently robust and balanced trade-off between tracking and reporting scope 3 emissions. |
| 3 | Tenant/contractor-related emissions | CIAL respects the legal rights of tenants to quiet enjoyment of tenancy and/or the need for information to remain commercial-in-confidence, and therefore, cannot demand data. Instead, CIAL invites tenant and contractor participation in a voluntary data sharing arrangement to estimate scope 3 GHG emissions where this information cannot be estimated using on-sold energy information. |
| 1, 3 | Diesel and petrol – stationary, transport | Fuels used for transport energy purposes produce slightly different methane and nitrous oxide emissions than if the same fuels were used for stationary energy purposes. Whether fuel is accounted for as fuel for stationary or transport purposes is based on whether fuels are used to move a vehicle.<br>Petrol and diesel premium products have been accounted for using the default emission factors for petrol and diesel. The resulting difference is negligible and does not constitute a risk of material misstatement.<br>• Transport fuels (mobile sources)<br>– AFS Fuel: Diesel for AFS and airside vehicles, 27,036 litres;<br>– Mobile fuel: |

[3] Email received from Jeeyoon Jung, Assistant Manager, Environment, ACI World, received 11 December 2019.

[4] Email from Alice Berry, WSP (ACA administrator), received 12 December 2019.

| Scope | Emission source | Assumptions, limitations and justifications |
|---|---|---|
| | | – Petrol, 912.4 litres;<br>– Diesel, 1,938.78 litres;<br>– BP Fuel:<br>– Petrol, 5,923.02 litres;<br>– Diesel, 14,949.55 litres;<br>• Stationary fuels<br>– Boilers and generators, B10 biodiesel blend, 422.978.05 litres,<br>– Reticulated LPG, 668,972kWh or 49,000kg.<br>It is noted that in the MfE Guide 2019, emission factors for fuel consumption are provided at a higher level (i.e.kg CO2-e/litre) than those for scope 3 travel emission factors (kg CO2-e/litre based on vehicle age, engine size and engine type of vehicle). |
| 1 | Stationary LPG | Calculated as stationary combustion of LPG for commercial use. |
| 1 | Refrigerant top-ups (losses) | HFC-134a (or R-134a) is used for commercial air conditioning. Losses associated with the use of HFCs typically arise from gradual leaks during normal operation, losses during service and maintenance, major equipment failures, or during decommissioning. Losses considered in this GHG inventory are those from replenishment purchases (i.e. top-ups, additions of refrigerant gases, see section 4.2.3 of the 2019 MfE Guide).<br>The following losses/top-ups were recorded in FY19:<br>• 54.4kg of R134a were transferred to CIAL in July 2018.<br>GWPs for refrigerants are taken from the IPCC's AR4, GWP for HFC-134a = of 1,430. |
| 1 | Fire training | CIAL uses LPG and wood for its fire training. LPG data was provided by Elgas in form of invoices (20171009_Elgas invoice.pdf and 20180718_Elgas Invoice.pdf) and denoted in litres. To calculate emissions from fire training, the litre amount has been converted into kilograms by dividing the litre amount by 1.96 (1kg LPG = 1.96l) and the converted kilogram amount was entered into the ACERT.<br>One tank of LPG (222kg) was ordered in FY19 but was used in FY20. As this will not show up in the FY20 invoicing, the 222kg of LPG have been included in FY19.<br>Emissions from wood used for fire training are based on the total amount of wood delivered to CIAL, i.e. 9$m^3$ (CIty Firewood export.xlsx, assumption of 50% = 4.5$m^3$ Oregon, 50% Pine = 4.5$m^3$). To convert volume into kilograms, a wood density chart provided by City Firewood (RE City Firewood weights.msg) was used. The conversions used were for the Oregon and Pine species, with an estimated weight of 452kg/$m^3$, and 473kg/$m^3$ respectively. The converted kilogram amount was entered into the ACERT.<br>Fire training using fire extinguishers (total of 135kg $CO_2$) was also provided. |
| 2 | Electricity | Emission sources includes purchased grid electricity for the passenger terminal, AFS/IOC, the Novotel, as well as miscellaneous smaller sources. This also includes electricity used for water pumps (ICPs can be isolated). CIAL is not on reticulated water supply. Instead, all water is taken from the aquifer. |
| 3 | All aircraft full flight (cruise, climb and descent GHG emissions) | Fixed wing aircraft with a maximum takeoff weight ('MTOW') over 5,700kg: Used the 2019 version of the ICAO CORSIA CERT. Half-way method used for MTOW over 5,700kg, apportioned 75% of emissions for MTOW less than 5,700kg and helicopters. |

| Scope | Emission source | Assumptions, limitations and justifications |
|---|---|---|
| | | Fixed wing aircraft MTOW < 5,700kg: Used specific fuel consumption rating for each engine (or similar engine), total engine horsepower, total engine run time (hours, calculated based on route and aircraft cruise speed), and average throttle setting across entire engine run (percentage) to estimate emissions.<br><br>Helicopters: Methodology under development as CIAL does not collect helicopter movement data on a regular basis. CIAL requested from Airways NZ all helicopter movements for the 12-month period between Mar-18 and Feb-19, which is similar to the FY19 period and as such is considered an adequate approximation.<br><br>As helicopters don't need to operate from an aerodrome, more often than not the route data is incomplete, a flight time value of 1 hour is assumed. Also estimated is the average throttle setting of 75%. |
| 3 | Third-party non-road construction vehicles and plant emissions | Emission sources included are those identified by the contractor issac, namely diesel consumption for specialist vehicles such as compactors and pavers, as well as petrol used in small tools and equipment. Of the total diesel consumption identified by the contractor, 50% is assumed to have been used for non-road construction machinery. The other 50% is assumed to have been used for smaller vehicles such as used and have been accounted for under tenant diesel for transport energy purposes. |
| 3 | APU | Electrified power supply (i.e. GPU usage) is included in scope 2 GHG emission estimate. APU usage assumes an average duration of APU operation before and after flights of 30 minutes for both small-medium and large aircraft. CIAL uses the ACERT to estimate this emission source. Average duration is entered under item 7.3 of the ACERT. |
| 3 | Staff business air travel | The MfE Guide 2019 uses passenger kilometres travelled and applies an emission factor based on class travelled. It also provides emission factors for air travel with and without radiative forcing (Tables 26, 27, 31 and 32, pages 53 and 57). While the choice of a multiplier is not necessarily incorrect, radiative forcing is not the correct metric for determining air travel's impact on climate change or the total climate response to long-lived gases. Using $CO_2$, $CH_4$ and $N_2O$ emissions together with a radiative forcing index would not only lead to double-counting of $CH_4$, but also not consider the effect of the release of nitrous oxides (NOx) on $CH_4$ (i.e. destruction thereof) and in turn a decrease in ozone.<br><br>The IPCC's fourth assessment report confirms that radiative forcing and the radiative forcing index ('RFI') do not attempt to represent aviation's overall effect on climate change and were not intended to be used to measure the effect of aviation on the climate as the RFI is largely a backward-looking metric and does not account for regional variation in impact (see e.g. Working Group 1, p. 133).<br><br>The MfE Guide 2019 states that a correction to the great circle distance (GCD) flown to account for aircraft not taking the most direct route due stacking, weather and traffic is not necessary as the MfE Guide 2019's emission factors are based on fuel delivery. Conversio notes, however, this approach assumes that all fuel uplifted is burned and does not take into consideration fuel planning (e.g. contingency fuel).<br><br>Passenger-kilometres are multiplied by the corresponding emission factors in Tables 26 and 31 of the MfE Guide 2019. The radiative forcing multiplier referenced has not used, but in line with current best practice, a multiplier of two has been applied. |
| 3 | Ground access | Ground access GHG emission estimates are calculated using the ACERT and include staff commute. Access figures are estimates based on the volumes of entries and exits into CIAL car parks. It is assumed that 80% of cars use petrol with the |

| Scope | Emission source | Assumptions, limitations and justifications |
|---|---|---|
| | | remaining 20% using diesel, that 20% of light duty vehicles use petrol with the remaining 80% using diesel and that shuttles, vans and buses use diesel. |
| 3 | Staff business travel – accommodation | Emission factors are taken from Table 33 of the MfE Guide 2019. The MfE Guide 2019 does not provide an emission factor for Fiji. As an approximation, the emission factor for the Caribbean was used. Given that this only affects one night and total contribution of this emission source is minimal, the risk of a material misstatement is considered insignificant. |

### 6.6 GHG emission sources not accounted for in carbon footprint

The following emission sources have not been estimated in the carbon footprint:

- Stored $CO_2$ in fire extinguishers other than those used for fire training – The contribution of this emission source to the total carbon footprint is de minimis.
- $SF_6$ – CIAL is not aware of any $SF_6$ sources being used in airport operations.

# 7. Carbon footprint

## 7.1 GHG emissions and energy consumption, facility aggregate

**Error! Reference source not found.**summarises the total GHG emissions for FY19.

**Table 6: Total scope 1, 2 and 3 emissions**

| | Scope 1 | Scope 2 | Scope 1 + 2 | Scope 3 | Scope 1 + 2 + 3 |
|---|---|---|---|---|---|
| **FY19** | 1,242 | 1,262 | 2,504 | 511,308 | 513,812 |

## 7.2 GHG emissions disaggregated by source type

Table 7 provides an overview of GHG emissions by source.

**Table 7: FY2018-19 GHG emissions by source type**

| **Scope 1: Direct emissions from owned/controlled operations** | **Activity data** | **Tonnes $CO_2$-e** |
|---|---|---|
| Biodiesel for stationary purposes | 422,978 litres | 1,011 |
| Diesel for transport purposes | 43,924 litres | 118 |
| Fugitive emissions from use of refrigerants for commercial air conditioning | 54kg | 78 |
| Petrol for transport purposes | 6,835 litres | 17 |
| LPG for stationary purposes | 5,086kg | 15 |
| Fire training | 9,211 kg | 3 |
| **Scope 2: Indirect emissions from the use of purchased electricity** | **Activity data** | **Tonnes $CO_2$-e** |
| Purchased electricity from the grid | 12,918,973kWh | 1,262 |
| **Scope 3: Other indirect emissions from the activities of CIAL, but occur from sources not owned or controlled by CIAL** | **Activity data** | **Tonnes $CO_2$-e** |

| | | |
|---|---|---|
| Aircraft – full flight emissions | 115,261 movements | 477,874 |
| Ground access, including staff commute | 3,583,379 vehicles | 26,777 |
| Aircraft – APU | 30 minutes | 3,201 |
| Engine testing/ run-ups | 2,727 run-ups | 1,486 |
| Staff business travel, air - international | 1,430,407 pkm | 463 |
| Diesel for transport energy purposes, tenants | 152,434 litres | 411 |
| Tenant electricity consumption, on-sold | 3,788,550kWh | 370 |
| Electricity transmission and distribution losses | 17,080,721kWh | 126 |
| Trade wastewater | 277 ML | 124 |
| Staff business travel, air - domestic | 569,181 pkm | 121 |
| LPG - stationary, tenant | 38,353kg | 116 |
| Waste to landfill with landfill gas recovery | 488 tonnes | 113 |
| Electricity - tenants, purchased from supplier (direct from off-site) | 373,198kWh | 36 |
| De-icing, tenants | 40,275 litres | 35 |
| Staff business travel, accommodation | 554 nights | 20 |
| Petrol for transport energy purposes, tenants | 6,835 litres | 17 |
| Non-road construction machinery and equipment (contracted) – diesel | 3,453 litres | 9 |
| Non-road construction machinery and equipment (contracted) – petrol | 129 litres | 0 |

# 8. References

## 8.1 Primary documents

| File name |
|---|
| 20171009_Elgas invoice.pdf |
| 20180718_Elgas Invoice.pdf |
| 201811_City firewood invoice.pdf |
| 2019 Emmissions Calculations - Helicopters.xlsx |
| 201905 Pax Movements - Previous Year Comparison.pdf |
| 201906 Pax Movements - Budget Comparison.pdf |
| 201906 Pax Movements - Previous Year Comparison.pdf |
| 201906 Pax Movements - Previous Year Comparison.pdf |
| 201906_Meridian TOU Breakdown.csv |
| 201906_Staff daily commute.xlsx |
| 20190611_City Firewood invoice.pdf |
| 201907_LTO workings.xlsx |
| 20190709 ETMS test report 01 July 2017 to 30 June 2019.xlsx |
| 7777 & 9999 HH Data.xlsx |
| ACERT gap analysis.docx |
| Air NZ Ramp.msg |
| APU vs FEGP.pdf |
| Campus Electricity.xlsx |
| Carbon Audit_201801_KPI Data_LCv1.xlsx |
| Carbon Source Data 24 july 2019.xlsx |
| CIAL - May 19 Energy Management Report.pdf |
| CIAL - May 19 Energy Management Report.pdf |
| CIAL EIR Report 01.07.16 to 30.04.19.xlsx |
| CIAL non TOU FY18-19.csv |
| CIAL TOU FY18-19.csv |
| CIAL Volume data 1.4.19 to 30.6.19.xlsx |
| CIty Firewood export.xlsx |
| Copy of Data Extract 2 - TOU Monthly Invoice History.xlsx |
| Corporate Travel.xlsx |
| Data request.xlsx |
| Deicing_Records_AirNZ_Planebiz.xlsx |
| Deicing_Records_Master_Spreadsheet.xlsx |

| File name |
| --- |
| EIR Report May 19 - CIAL Exported Data.xlsx |
| Elec data april may 2019.msg |
| ELec Data.msg |
| Elec gap between Contact and Meridian.msg |
| Energy Management - June - 2019.xlsx |
| FW refrigerant gas and CIAL.msg |
| FW Clarification required - fuel use.eml |
| FW Fuel consumption.eml |
| FY19 Emissions Calculations - Aircraft MTOW under 5700kg.xlsx |
| FY19 Waste Water meter.csv |
| FY19_ACERT_5.0_v2017-06-05_public excl mil.xlsx |
| FY19_ACERT_5.0_v2017-06-05_public.xlsx |
| green-wood-weights.xls |
| Ground Transport data.msg |
| GT ACERT Data (002).xlsx |
| ICAO_CORSIA_CERT_2019_CIAL_20200922.xlsm |
| ICP Details.csv |
| ICP explain.xlsx |
| Monthly Energy Management v1.xlsm |
| ORBIT data Export.xlsx |
| PowerusedataNHH_NHHRAW_20190708_1422.csv |
| PowerusedataTOU_TOURAW_20190708_1421.csv |
| Quarantine Waste.xlsx |
| RE Calculating Biodiesel Blends.msg |
| RE Christchurch Airport Carbon Footprint Mapping.msg |
| RE City Firewood weights.msg |
| RE CO2 training use.msg |
| Refrig data.msg |
| Swissport.msg |
| TABLEAU EXPORT_Carbon Source Data.xlsx |
| Travel Summary.docx |
| Verification_Report_1415_CIAL_Org.pdf |
| Verification_Report_1516_CIAL_Org.pdf |
| Verification_Report_1617_CIAL_Org.pdf |
| wASTE CHART EXPORT.xlsx |

## 8.2 Secondary documents

| Reference | Description |
|---|---|
| 1 | ACA Guidance Document, Issue 11 |
| 2 | ISO 14064-1:2018 |
| 3 | GHG Corporate Protocol |
| 4 | Corporate Value Chain (Scope 3) Accounting and Reporting Standard |
| 5 | Scope 2 Guidance |
| 6 | Airports International Council's Guidance Manual: Airport Greenhouse Gas Emissions Management |
| 7 | Airport Cooperative Research Program's Guidebook on Preparing Airport Greenhouse Gas Emissions Inventories |

## 8.3 Interviewed persons

| Reference | Description |
|---|---|
| 1 | Claire Waghorn, Sustainable Transition Leader |
| 2 | Rohan Appleby, Financial Analyst |
| 3 | Nick Wood, Commercial Data Analyst |
| 4 | Martin Crockford, Manager - BI Systems |
| 5 | Jessica Royal, Environment Advisor |
| 6 | Brodie Akacich, former Sustainability Manager |